

A2
cont

depicted in Figs. 1A-1G, there are no areas within the path of blood flow that can become stagnant, diminishing the potential for damage to blood cells caused by undue turbulence and also diminishing clot formation.--

In the Claims:

Cancel claims 16-18, 23, 25, 27, and 29-30 without prejudice.

Amend claims 1, 7, 14, 19, 21, 24 and 26, and add new claims 32 - 42 as follows:

A3

1. (AMENDED) A fluid pump comprising:

an elastic bladder, at least a portion of the interior surface area of said bladder being changeable between a contracted state have a first surface area and an expanded state having a second surface area that is substantially greater than said first surface area, said bladder having a fluid inlet and a fluid outlet;

means for alternately expanding and contracting said bladder to change the interior surface area and volume of said bladder; and

means for causing substantially one-way fluid flow through said bladder.

A4

7. (AMENDED) A fluid pump as in claim 2, wherein said bladder and said actuating fluid are a unitary body of semisolid material, the surface of said semisolid material functioning as said bladder interior surface.

A5

14. (AMENDED) A fluid pump as in claim 1, wherein said bladder inlet and outlet are configured for attachment to a blood circulatory system, and wherein said fluid is blood.

a⁶
19. ⁸(AMENDED) A fluid pump as in claim 1 for use as a ventricular assist device for a heart, wherein said outlet from said bladder is configured for connection to the aorta of the heart.

a⁷
21. (AMENDED) A blood pump comprising:
a housing;
an extensible and contractible bladder in said housing, a space defined between said housing and said bladder for receiving a bladder driving fluid, said bladder having an inlet and an outlet;
a check valve to at least one of said bladder inlet and outlet; and
means for altering the pressure of the driving fluid to alternately expand and contract the interior surface area and volume of said bladder in a pumping cycle, said pressure altering means operable to maintain the pressure between a high pressure and a low pressure, said low pressure being below atmospheric pressure, most of said interior surface area of said bladder adapted to elastically expand in response to said low pressure and contract in response to said high pressure with each said pumping cycle.

a⁸
24. ¹⁵(AMENDED) A blood pump as in claim 35, further comprising at least one extensible strut spanning the interior of said bladder.

a⁹
26. (AMENDED) A method of pumping a fluid, comprising the steps of:
providing an extensible and contractible bladder having an inlet and an outlet;
connecting the inlet and outlet of the bladder to a fluid circulation system;

29 cont

expanding the interior surface area and volume of said bladder to draw fluid in through said inlet;
storing elastic energy in said bladder as said bladder is expanded;
closing said inlet;
recoiling said bladder to release said elastic energy; and
contracting the interior surface area and volume of said bladder to expel fluid through said outlet, said release of elastic energy contributing to said contracting step.

12
32. (NEW) A fluid pump comprising:

aid

a bladder, at least a portion of the interior surface area of said bladder being changeable, said bladder having a fluid inlet and a fluid outlet, said bladder having thickness variations for controlling the expansion and contraction of said bladder;

means for alternately expanding and contracting said bladder to change the interior surface area and volume of said bladder; and

means for causing substantially one-way fluid flow through said bladder.

13
33. (NEW) A fluid pump comprising:

a bladder, at least a portion of the interior surface area of said bladder being changeable, said bladder having a fluid inlet and a fluid outlet;

means for alternately expanding and contracting said bladder to change the interior surface area and volume of said bladder;

means for causing substantially one-way fluid flow through said bladder; and

at least one extensible strut spanning the interior of said bladder for controlling its expansion and contraction.

34. (NEW) A fluid pump comprising:

a bladder, at least a portion of the interior surface area of said bladder being changeable, said bladder having a fluid inlet and a fluid outlet;

means for alternately expanding and contracting said bladder to change the interior surface area and volume of said bladder;

means for causing substantially one-way fluid flow through said bladder; and

one or more bands on said bladder for controlling its expansion and contraction.

35. (NEW) A blood pump comprising:

a housing;

an extensible and contractible bladder in said housing, a space defined between said housing and said bladder for receiving a bladder driving fluid, said bladder having an inlet and an outlet;

a check valve to at least one of said bladder inlet and outlet;

means for altering the pressure of the driving fluid to alternately expand and contract the interior surface area and volume of said bladder to define a pumping cycle, most of said interior surface area of said bladder adapted to expand and contract with each said pumping cycle; and

a fluid pressure regulator in said space to selectively control the rate of expansion or contraction of selected areas of said bladder.

36. (NEW) A method of pumping a fluid, comprising the steps of:

providing an extensible and contractible bladder having an inlet and an outlet;

connecting the inlet and outlet of said bladder to a fluid circulation system;

expanding the interior surface area and volume of said bladder to draw fluid in through said inlet, said expanding step comprising initially expanding a portion of said bladder adjacent said inlet and gradually expanding the remaining portions of said bladder from said inlet towards said outlet;

closing said inlet; and

contracting the interior surface area and volume of said bladder to expel fluid through said outlet.

37. (NEW) A blood pump comprising:

a housing;

an elastic bladder contained within said housing having an interior volume containing blood at arterial pressure;

at least one check valve in communication with said bladder for causing substantially one-way fluid flow through said bladder;

a space defined between said bladder and said housing;

a driving fluid in said space; and

means in communication with said space and for, alternately, decreasing the pressure of said driving fluid to a low pressure that is below atmospheric pressure, said elastic bladder responding to said decreasing pressure by elastically stretching to store elastic energy in said bladder, to increase bladder surface area and volume and to draw blood into said bladder, and increasing the pressure of said driving fluid to a high pressure that is less than or equal to arterial pressure, said elastic bladder responding to said increasing pressure by elastically contracting to release elastic energy from said bladder, to decrease bladder surface area and volume and to pump blood from said bladder.

38. (NEW) A method for reducing the formation of blood clots during blood pumping, the method comprising the steps of:

A

providing a blood pump having an elastic bladder having an interior and an interior surface area; and

changing said interior surface area by alternately elastically stretching said bladder and elastically contracting said bladder, said changing surface area operative to reduce the formation of blood clots on said interior surface area.

aid
cont

18
39. (NEW) A method for reducing the formation of blood clots during blood pumping as defined by claim 38, wherein said elastic bladder is enclosed in a housing, a space defined between said bladder and said housing, and wherein the step of stretching and contracting said bladder includes elastically stretching said bladder by decreasing pressure in said space to below atmospheric, and contracting said bladder by increasing the pressure in said space.

40. (NEW) A fluid pump as defined by claim 2, wherein said means for alternately expanding and contracting said bladder are operative to vary the pressure surrounding said bladder between a high of about atmospheric and a low of below atmospheric, said bladder being expanded when said pressure is at said low pressure and contracted when said pressure is at said high pressure.

41. (NEW) A fluid pump as defined by claim 1 wherein said means for alternately expanding and contracting said bladder comprises a mechanical drive.

22
42. (NEW) A fluid pump as defined by claim 1 wherein said bladder is comprised of a plurality of different materials.